

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**In re Application**

Inventors: DeOrnellas, et al.

Application No.: 09/692,007

Confirm. No.: 7175

Filed: October 19, 2000

Title: **METHOD FOR USING A HARD MASK FOR  
CRITICAL DIMENSION GROWTH  
CONTAINMENT**

**PATENT APPLICATION**

Art Unit: 1765

Examiner: L. Umez Eronimi

Customer No. 23919

**DECLARATION UNDER 37 C.F.R. § 1.131**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

I, Stephen F. DeOrnellas declare as follows:

1. That I am a named inventor in the above-referenced U.S. Patent Application No. 09/692,007, hereinafter cited as the '007 application.
2. That I am a named inventor in U.S. Patent 6,287,975 filed January 20, 1998, to which the '007 application claims priority.
3. That I have reviewed the latest claims describing the invention in the '007 application that were filed with an Office Action Response on April 16, 2004.
4. That attached lab notebook entries include: (1) pages 77, 78 and 81-83 from the lab notebook of Kurt Olson, an employee of Tegal, the assignee of the '007 application (hereinafter the Olson notebook); and (2) pages 53-100 from the lab notebook of Alford


Cofer, a co-inventor of the '007 application and employee of Tegal (hereinafter the Cofer notebook). Note that some information has been redacted from both the Olsen and Cofer notebook entries.

5. That the Olsen lab notebook entries were witnessed by Lance McCullough (an employee of Tegal) and Kurt Olson, and were made at my direction and with my knowledge at the time the entries were made. Further, the Cofer notebook entries were made at my direction and with my knowledge at the time the entries were made.
6. That I believe the lab notebook entries show conception of and reduction to practice of the claimed invention in the '007 application prior to January 20, 1997, a date one year before the earliest priority date of January 20, 1998 for the '007 application. I believe conception before January 20, 1997 is shown at least by pages 77, 78 and 81 of the Olsen notebook, with page 77 illustrating the conception of the hard mask, with page 78 illustrating etching in the presence of fluoride and adding energy in the form of temperature at 180-300 degrees Celsius, with page 77 illustrating the concept of etching in a stream of oxygen, and page 81 illustrating the hard mask in one embodiment to be titanium. I believe reduction to practice is shown as early as January of 1997 by data for a process performed on page 83 of the Olsen notebook, in particular the process is described using a hard mask with a process temperature of 75 degrees Celsius.
7. Further, I believe the lab notebook entries show diligence from conception before January 20, 1997 until filing of the present application on January 20, 1998. Conception is shown prior to January 20, 1997 as evidenced in the Olsen notebook indicated above. Diligence (as well as further reductions to practice) is shown from at least May of 1997 through January of 1998 by pages 53-100 of the Cofer notebook.

8. That the above statements were made with the knowledge that willful false statements and the like are punishable by fine and/or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that any such willful false statement may jeopardize the validity of this application or any patent resulting therefrom.

12-28-04

Date

  
Stephen P. DeOrnellas



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Examiner: L. Umez Eronini

Customer No. 23910

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Date

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Stephen P. DeOrnellas



## **Lab Notebook**

**of**

**Kurt Olson**

**Dated: -----**

**pages 77, 78 and 81-83  
(Dated through January 20, 1997)**

Hard Mask0.40 <sup>pitch</sup>

line space 4 wafers

0.36 <sup>pitch</sup>

line space

1 wafer

many

(Maybe already Done By Fab)

OE

① ~~2 mT / 500 / 100 80% O<sub>2</sub>~~ 40% 70%② → 2 mT / 400w / 100 80% O<sub>2</sub> 40 70%

③ ? equal

④ ?

① → 2 mT / 500 / 100 80% 40% 70%

Wavelength #4

814 nm

Argon/Cl<sub>2</sub>

Mr. Nam

Wanted.

1 wafer

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Idea for Patent

Notebook No. \_\_\_\_\_

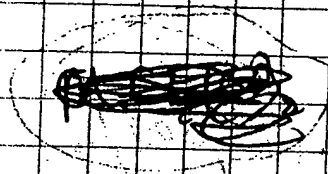
Continued From Page \_\_\_\_\_

To Etch Platinum or other similar non-volatile metal  
for Patterning small dimensions or Pt removal from  
etch chamber surfaces or prevention of Pt deposits on chamber  
Create the compound  $PtCl_2(PF_3)_2$  by feeding

$Cl_2$  and  $(PF_3)$  or  $Cl$  Donor and  $(PF_3)$  donor  
into a plasma reactor

$PtCl_2(PF_3)_2$  is known to be volatile @  $\sim 180-300$   
(and stable)

Reference to Article by Chatt, J. in  
Nature V.165 April 22 1950



Continued on Page \_\_\_\_\_

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1/7/96

~~16 PATTERN~~  
16 Patterned Resist 96291 P For Deposit/Volatile Product  
8 EOR  
8 HardMask wafers 963374  
8 Patterned TEST 961782p Bids Vail  
10 Blanket Pt 963031 P  
~~6 Pts~~  
12 blanket Ti (300Å) over SiO<sub>2</sub> (1000Å)

Continued on Page \_\_\_\_\_

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Date \_\_\_\_\_

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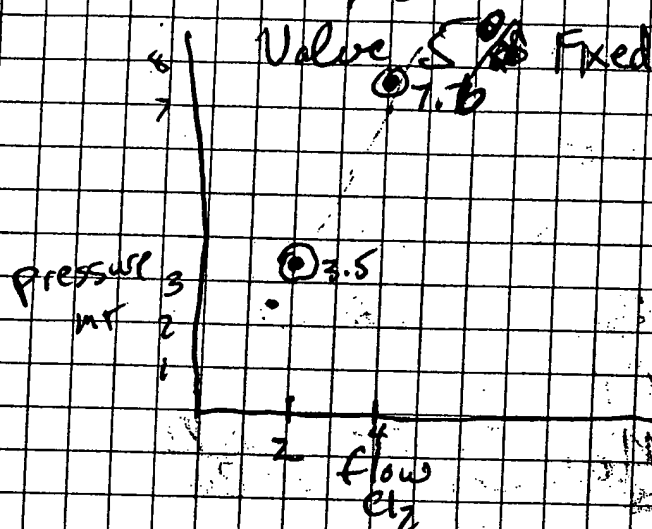
Date \_\_\_\_\_

→ Try New Process on Hm.

1)  $20\text{ Ar} / 2\text{ Cl}_2$

Enter Start He 80/80 60 Ar / 2 Cl<sub>2</sub>

Test Linearity of Cl<sub>2</sub>



Flow SET

2	3.5	3.5
4	7.6	
8	15.9	

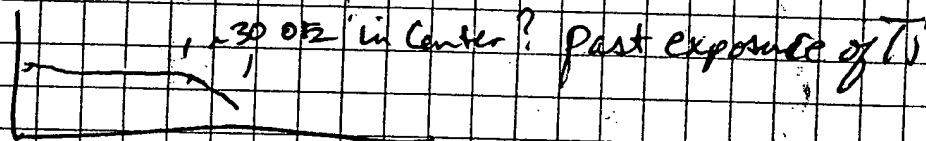
10 (Read 1.5)	2.5
0 (Read 0)	0.2

@ low Cl<sub>2</sub>  
use Readout for Cl<sub>2</sub> Flow  
Not Set

2) 60 Ar / 2 Cl<sub>2</sub>

Cl<sub>2</sub> Reads 1.9

- 28 sec He Fault Stop Restart Orange Plasma + 211



3) 20 Ar / 7 Cl<sub>2</sub> Partial Etch

51 sec Etch

more Gray Plasma

Continued on Page           

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1/20/97

hardmask (recipe name)

> 60 Ar / 4 Cl<sub>2</sub> / time 150 < X < 240 (recipe #s) 500/120 Watts

check He fault bands

terminate whenever Pt just clears

close left to right request dense &amp; end of array &amp; field end of array profile

slot	type	He flow	Valve	EP	Time	notes
1	Si	3.6	24.4	2.1	65	75°C/75°C
2	HMI6	3.2	25.1	46.5		stat - He flow = 2.9 sccm OOPS 158 + 119 = 269 s could not see endpt. file name 20-Jan 10:51am lot 40 wfr. 2

Clean window

(vent w/ N<sub>2</sub> & keep N<sub>2</sub> on) leak rate 2.7/mbar

1	Si	3.7	24.5	46.9	62	endpt. file name 20-Jan 1:22pm lot 41 wfr. 2
2	HMI7	3.4	25.5	52.0	123	meas. Oxide thickness = 1370 Å

Submit to SEM

probe - 9 Cl<sub>2</sub>/20A 500/100 probe @ reactor temp.

Continued on Page \_\_\_\_\_

140 sec (to end pt.) plus 30 sec. into SiO<sub>2</sub>

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Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_



# **Lab Notebook**

**of**

**Alferd Cofer**

**Dated: December 13, 1996 through January 1, 1998**

**pages 53-100**

**(Dated May 14, 1997 through December 4, 1997)**

Appo 1 - PM 4.

5/14/97

at 40°C 1°A chuck-up

38.9 out 39.9 10 Wafer Elect

145 pF chuck up 5: wf

Chamber 75°

10A<sub>1</sub>/10C<sub>2</sub>

10° 10.7 mD 19.2 mD.

$$Q = \frac{L}{R}$$

Install date  
T-match -

5/15/97

40A<sub>1</sub>/10C<sub>2</sub>/200W

	RF A	RF on	$\Delta$
10°	11.0 mD	10.4	- .6
18°	5.1 mD	<del>5.0</del> 4.8	- .3
40°	2.0 mD	2.1	+ .1

- 760 V 500W 5 mD, 20/10 C<sub>2</sub>

- 1480  
(500/200)

Continued on Page \_\_\_\_\_

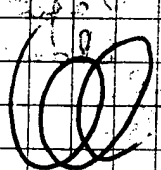
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Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_



CR. (1.53) Wf (1.73)

~~1.73~~

75° 4.2% 42° 3.3% min.

	6:40		39.3	39.9	1.7 GPM
	6:50	75°/49°	44.6	45.6	1.7 GPM
55°	7:00	75°/56	51.1	52.0	1.7 GPM

$$\text{500W} = \frac{E^2}{R}$$

25000

3.2 Arms  
158 Vrms 500W

Continued on Page

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PROJECT \_\_\_\_\_

Continued From Page \_\_\_\_\_

Eng Probe 1160  
~~1350 V~~  
 32.0 34.4 A 427 V RMS  
 9.7 RMS SN#24

Proceas 1900V ~~2020 V~~  
 27.2A ~~28.8 A~~ 492  
~~522~~ RMS  
 SN#33

1600 440 V RMS

	V	RMS	A	RMS	
500 W 10uA	480	156	8.00	2.62	8N 33
5uA	480	154	8.00	2.61	
	480	156	8.00	2.65	SN 24

AVProbe 496 174  
 20MHz BW 448 154

	20MHz	60MHz
#33	1220 340	1860 485
	25.2 8.6	27.2 9.74

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Date \_\_\_\_\_



90° 0.5 cm 1 mV

	90°	40°	18°	10°	At	Cl	RF
	1.6 mV	2.3 mV	5.4 mV	11.8 mV	"	"	"
					37.5	12.5	0
					"	"	"
					"	"	"

$\Delta - .3 \text{ mV}$	10°	11.5	"	"	700
$\Delta + .6 \text{ mV}$	18°	6.0	"	"	"
$\Delta + .2 \text{ mV}$	40°	2.5	"	"	"

100

1 V

1 V

0.3 V

0.15 V

(0.3 mV)  
(0.15 mV)

10°

11.5 mV

700 W

11.3

500 W

11.0

300 W

10.9

500/100

12.3

500/200

11.5

500/0

10.8

500/0

5.7 mV

500/100

7.1 mV

500/200

Continued on Page

5.4

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Date

PROJECT \_\_\_\_\_

Continued From Page \_\_\_\_\_

(190 kHz 5.2 ps Pressure Turbo 8)

73.0	- 74.1	0 power
72.3	73.5	500W
73.2	74.6	2500/200
72.8	73.6	0 power

72.6	76 Ch
73.2	78 Elect
	5.8 l/m
	3.4 l/m
79 Chiller	
1.75 BHP	

A <sub>1</sub> Q <sub>2</sub>		0 W		700 W	
37.5/12.5	10°	10.0 mtd		8.5 mtd	1.7 V 40 kHz
	18°	4.7 mtd		4.5 mtd	1.6 V "
	40°	2.0 mtd		2.2 mtd	1.8 V "
	90°	1.2 mtd			

Continued on Page \_\_\_\_\_

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Date \_\_\_\_\_

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Date \_\_\_\_\_

	700W	5W
10°	7.5 mV / .5V <sub>pp</sub>	10.3 mV
	NO RF	RF on
10°	11.2 1.16V	9.1 mV 1.18V .68V
18°	5.3 .56V	4.8 mV .74V .24V
40°	2.3 .24V	2.2 mV .46V -.04V
	RF NO	
	10.2 11.7	
	5.6 5.5	
	2.7 2.4	

SN#28	→ 28A	1220 V <sub>pp</sub>	@500W	12.6 NS
SN#35	28.4A	1110 V <sub>pp</sub>	@500W	17.2 NS
SN#24	32.0A	1160 V <sub>pp</sub>		
SN#33	27.2A	1900 V <sub>pp</sub>		

	37.5/12.5	5 mV 700W	
40 mV 48V .27 10°	12.4 10.4 9.7 mV		9.0
	5.7 120W X 4.6 mV		5.2 5.8
	2.6 .14V 2.4		2.5

Continued on Page

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Date

5/22/97

~~\_\_\_\_\_~~ Ti Mark 300 A

#1 5mb, 500/0w, 5 Cl<sub>2</sub>/20 H<sub>2</sub>, 5T, 80/80, 40°  
 → 10mb, 450/0w, 4 Cl<sub>2</sub>/40 O<sub>2</sub>, 60° 60° 9.5°

#2 5mb, 450/0w, 4 Cl<sub>2</sub>/40 O<sub>2</sub>, 120° -510V  
 15.6° 300A etch?

#3 60° at 5mb No Ti etch  
 72° at 10mb No Ti etch  
 at 2nd Ti Bkth in 20° clear in 45°  
 2844 w/Resist step

re-etch #2 at 5mb, 450/0w, 7 Cl<sub>2</sub>/40 O<sub>2</sub>, -800V  
 1583A step. 120°

B1 5mb, 450/60, 7 Cl<sub>2</sub>/40 O<sub>2</sub>, 180° 1200A - 820V

3.5 mb, 500/0, 5 Cl<sub>2</sub>/20 H<sub>2</sub>, 60° Bkth. 105° -

Ti Mark <sup>mistake</sup> 3.5mb, 500/0, 5 Cl<sub>2</sub>/20 H<sub>2</sub>, 120° -580 1000V  
 27.2A pp

Ti Open 3.5mb, 500/0, 5 Cl<sub>2</sub>/20 H<sub>2</sub>, 55°  
 Man. Als

	.2	.0	
1.6	1.3	3.6V	PP
10.8	10.1		
9.2	8.4		
1.6V	1.7V		

Continued on Page \_\_\_\_\_

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Date \_\_\_\_\_

60  
PROJECT \_\_\_\_\_

Notebook No. \_\_\_\_\_  
Continued From Page \_\_\_\_\_

6346A<sup>0</sup> PR Starting [REDACTED]

10.7 11.0

1.7 mb, 800/140w, 5.4 Cl<sub>2</sub> / 10.2 HB<sub>1</sub> / 9.2 H<sub>2</sub>

14.6  $\Omega$   
17 m  $\Omega$

Continued on Page

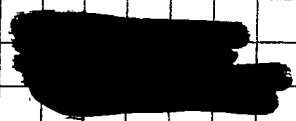
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Date \_\_\_\_\_

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Date \_\_\_\_\_



→ Mask Ti check pattern @ 3.5 ml 55'

→ Check on 4 pt probe?

→ Test in HDT, PSC and 915

→ over bake Tests

9540

8365

9380

9312

9100

9237

6/10/97

2000 (1200 A) total  
1000 A  
Ti

5mb, 500/0, 5 Cl<sub>2</sub>/25 H<sub>2</sub>, 60"

D7

PT

5mb, 450/60, 8 Cl<sub>2</sub>/40 O<sub>2</sub>, 90"

-780V

Q2

956 A step 1000 A ears.

1700A (700 miles)  
D7

5mb, 500/70, 8 Cl<sub>2</sub>/40 O<sub>2</sub>,

180°

-880V

#1

5mb, 500/0, 7 Cl<sub>2</sub>/20 H<sub>2</sub>,

90° didn't clean

4375 PR

Continued on Page \_\_\_\_\_

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Date \_\_\_\_\_

$\mu$ -scope lens  $\frac{1}{2}$ " 12mm CF PL 2.5X  
outer Dia. (pen cap to ridge)

[illegible]

6700

F58 443  
8.9A

4.8 V      1600 V<sub>pp</sub>      KHz

9V 1440V<sub>pp</sub> Mhz

7.  $28V_{100}$   $2280V_{pp}$   $KHz$   $1640MHz$   $V_{100}$

5m, 500%, 100, 20A,

SN 15	$\frac{640}{524}V$	8.8A	$\frac{1.2}{0.8}NS$	2500V	29.6	720VDC	16.8A
-------	--------------------	------	---------------------	-------	------	--------	-------

1540VK 352A-1200VK 1580

SN28 472V 7.0A 1.6NS 1080V 26.4A-752V 17.1NS

1980 V/A 31.21 - 1220 V/A 1480 V/A

SN33	464	7.2A	18MS	1320 VM	228.8-780VM	24.1ms
------	-----	------	------	---------	-------------	--------

1530V 33.0A = 1240 148V

SN04	880V	7.6A	0.834W	384A	-760	760W
------	------	------	--------	------	------	------

28401	231A	-1240	2320
-------	------	-------	------

[illegible][illegible][illegible]

900 ~~200~~ Mt Continued on Page

[illegible]

Continued on Page

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Date \_\_\_\_\_

H1 5mb, 500/70, 8 Cl<sub>2</sub>/400<sub>2</sub>, 240° - 800 940K 1020M  
26.4A 5+

D6 5mb, 500/0, 5 Cl<sub>2</sub>/20HB<sub>1</sub>, 70°EP 90° 5260A PR

6/13/92  
E6 4mb, 500/0, 5 Cl<sub>2</sub>/10 HB<sub>1</sub>, 90° No Etch  
5mb, 500/0, 5 Cl<sub>2</sub>/20 HB<sub>1</sub>, 60° 3500PR 500A new

D6 5mb, 500/70, 10 Cl<sub>2</sub>/400<sub>2</sub>, 270° oxide!! 2100-  
300A new 2300A stop  
5T

E6 Messed up 70° mark RBC etch

E6 5mb, 500/70, 10 Cl<sub>2</sub>/400<sub>2</sub>, 5T, 70° + -880V DC  
2200VM 28.8A 1990KV

7mb 40° No Pkth.  
E4 2nd 5mb, 500/0, 5 Cl<sub>2</sub>/20HB<sub>1</sub>, 70°

300A  
A → D3 1st 5mb, 500/0, 5 Cl<sub>2</sub>/20HB<sub>1</sub>, 60° 20°EP 1880VM-580

300A F 5mb, 500/0, 5 Cl<sub>2</sub>/20HB<sub>1</sub>, 60° No Pkth.  
4mb, 30° Pkth + 60° 12.1°V

300 D3 5mb, 500/70, 10 Cl<sub>2</sub>/400<sub>2</sub>, 240° .18μ Top .64μ Bottom  
5T

600 E4 5mb, 500/50, 10 Cl<sub>2</sub>/400<sub>2</sub>, 360° .18μ Top 73° .28μ Bottom

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Etol (mask pre-stel)  
Ti Layer 90" Break strip 1/4 3 spld  
per part / part string  
Etol 300 ft 90" 240 F  
Etol 300 ft 90"

11.4  
5.5  
2.5

	SN	W	V	A	M	NS
11.4	500W	1220V	31.2A	18.0		
	200W	1184V	33.6	17.6		
	500/100	1400	32.8	-1320	-DC	
5.5	50W	1340	28.0			
	700	1560	31.6	20.0	NS	
	500/100	1520	32.8	-1340		

SN 35	-800	1280	883	280	9.21	17.2 NS
SN 28	-800	1280	895	28.0	9.30	17.6 NS
SN 14	-800	1520	942	28.0	9.31	14.4 NS

SN 35	4.80	156	7.20	2.44	0 NS
SN 28	4.72	160	7.59	2.55	.4 NS
SN 14	4.52	154	7.20	2.48	0 NS

A 6 634 548 838  
EP 587 510 837

F 716 -718 8.59A

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Date \_\_\_\_\_

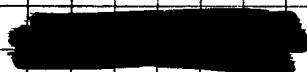
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Date \_\_\_\_\_

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Continued From Page \_\_\_\_\_

SN 75



6/18/97

A 6 5mb, 500/0, 500/200B, 90° 617A Aug

B 6 " 60°

F 6 5mb, 500/40, 1000/400, 240°

SN 14	320	109	6.16	2.10	
	400	138	7.84	2.72	ONS
	472	162	9.28	3.21	

SN 28	332	113	6.50	2.21	
	420	145	8.24	2.85	2 NS
	488	171	9.68	3.31	

SN 35	336	115	6.48	2.19	
	424	147	8.24	2.86	2 NS
	496	172	9.60	3.35	

	300 W				
300	V <sub>pp</sub>	V <sub>rms</sub>	A <sub>pp</sub>	V <sub>rms</sub>	
SN 33	300W	328	113	6.72	2.28
	500W	420	144	8.56	2.92
	700W	488	168	10.0	3.47

SN 15	348	123	7.04	2.86	
	444	152	8.96	3.07	ONS
	516	181	10.5	3.65	

V in connector  
Bad.

SN 04	632	220	6.96	2.37	
	800	281	8.88	3.06	ONS
	860	3019	10.4	3.62	

V Double  
real #

Continued on Page \_\_\_\_\_

Read and Understood By \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

PROJECT \_\_\_\_\_

Continued From Page \_\_\_\_\_

-80V 1100V<sub>pp</sub> 28.8A<sub>pp</sub>

Continued on Page \_\_\_\_\_

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Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

6/19/97

~~G8~~ 3.5 mb, 500/0, 5Cl<sub>2</sub>/20H<sub>2</sub> 60"  
 B7 5.0 mb, " " " 60" T<sub>i</sub> E<sub>P</sub>  
 -620 670-880

A6 5mb, 500/0, 10Cl<sub>2</sub>/40O<sub>2</sub>, 270°+120°  
 -5700C 912Vrms 632mV 7.99A 17.2Ns

5mb, 500/0, 15O<sub>2</sub>/40Ar, 60" 2013A  
~~G8~~ 5mb, 500/0, 10Cl<sub>2</sub>/40O<sub>2</sub>, 206"

B7 5mb, 500/40, 10Cl<sub>2</sub>/40O<sub>2</sub> 360° -775 1780 819 8.51

F5 5mb, 500/0, 5Cl<sub>2</sub>/20H<sub>2</sub>, 90° No Rkt + 0.4mb 90°  
 E3 " " " 20" Rkt E.P. +20°

Matrix Started

T<sub>i</sub> 6/25/97

11.0° Valve Angle  
 5mb, 500/0, 5Cl<sub>2</sub>/20AB, 60" 5 wfs  
 50" 4 wfs  
 45" 6 wfs

-680V 1100Vpp 28.8A<sub>pp</sub>

F0 B7 512/737  
 E2 486/1833 A2  
 D4 917/1528 E6  
 G7 1112/1142 A1  
 FL 1739/3050 D3 400/1733  
 A7 814/2212 F6 spare

smaller  
wells

Continued on Page

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Date

Signed

Date

T5 4  
T8 3  
T10 7  
T12 8

30.0

3.2

2.0

33.5

*[Signature]*

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Read and Understood By

Signed

Date

Signed

Date

PROJECT \_\_\_\_\_

Continued From Page \_\_\_\_\_

7/9/97

Cu

ST T<sub>ex</sub>#1 5mb, 500/120, 8Cl<sub>2</sub>/60Ar, 200° Resist gone 2K step

#2 5mb, 500/70, 12Cl<sub>2</sub>/20Ar, 290° Resist gone sel. to low

ST #3 5mb, 500/100, 4Cl<sub>2</sub>/60Ar,

DT #4 5mb, 500/200, 2Cl<sub>2</sub>/60Ar, 300° Burned PR

IT #5 5mb, 500/150, 2Cl<sub>2</sub>/60Ar, 300° + 60° Some Burned PR (Best Etch)

#6 Strip only Heavy OX. incamp. strip (1 hr. 915)

4" Cold DUV #7 5mb, 500/150, 2Cl<sub>2</sub>/60Ar, 360° 2' steps wrinkled PR not clear.

Cold DUV #8 5mb, 500/150, 2Cl<sub>2</sub>/60Ar, 590° 3' steps wrinkled PR mod. Res.

" #9 " " " " 300° 1 step wrinkled PR heavy Res (more OE? not)

— #10 3.7 5mb, 500/200, 2Cl<sub>2</sub>/60Ar, 270° 300° Clear center.

T#11 wide open 2.0 mb, 500/200, 2Cl<sub>2</sub>/60Ar, 170° Not clear

T#12 " " " " 210 180° clear

— 15" 90-150°C 240° High DUV

T13 1.5 mb, 600/150, 5Cl<sub>2</sub>/40Ar, 60° + 100° + 120° @ 15mb.

T17 2.5 mb, 500/150, 3Cl<sub>2</sub>/60Ar/60Ar, 220° + 100°

Continued on Page \_\_\_\_\_

Read and Understood By \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

3 1/2 : 1  
4.5 : 30

30 Flow Constants  
1 T. Clamp  
90° O.E. Time

2:1 2 20 A 10 H A  
3.5:1 4 45 22.5 7 H A  
5:1 6 28 4

30 10/20 2  
30 6/24 4  
30 4/24 6

245

43  
7 30  
28  
20 25.8

Continued on Page

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Date

Signed

Date

7/18/97

DØ 3 mb, 500/0, 8 Cl<sub>2</sub>/20 A, ~~40~~ = 40" 5T

Ab " " " " 30" 1T

1T  
Ab 3 mb, 600/100, 8/27, 120" + 80"

DØ " " " 140"

— 5 mb, 500/0, 8 Cl<sub>2</sub>/20 A, 50" 1T  
55"

⊙

18° FI 3 mb, 600/100, 7/21, 140" EP + 60" 2287

17.0° C5 120" EP + 80" HB for Cl<sub>2</sub> 2245T/8 2.0 mb, 500/200, 2 Cl<sub>2</sub>/60 A, 60" + 150"  
+ 4 HB, ~~240~~ 240"A 4 3 mb, 600/100, 7/21, 130"  
500/200, 0/7/21, 180"Need 2T  
Clamp↑ HB killer may  
need to use only 2 additionalEZ 3 mb, 600/100, 8/12/20, 130"  
9.4% 6 mb, 700/100, 8/12/7, 130"Press A  
Lower HB  
No Cl<sub>2</sub> OE.

Continued on Page

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Signed

Date

Signed

Date



4. BPA Vials

400 RT	800	1300	5600	—
300 RT	500	1300	1400	FS
"	800	<del>900</del>	1000	<del>20</del> A6 —
"	800	1600	2300	<del>20</del> F0

Continued on Page

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Signed

Date

Signed

Date

PROJECT \_\_\_\_\_

7/24/97

Ti Mask open

IT H<sub>2</sub> 80°/80°C 1st wf 70" 600A 3<sup>rd</sup> 55"\* 11.5° 5mt, 500/0, 8Cl<sub>2</sub>/20H<sub>2</sub>

E.P. over Pt at 519, 514, 503, 740 (rise)

2<sup>nd</sup> ? wf.9<sup>th</sup> E.P. early 300A Ti?E3 2mt, 600/100, 4Cl<sub>2</sub>/12O<sub>2</sub>, 120" 85°EP.2mt, 800/200, 10HBr/20O<sub>2</sub>, 110" Too Long

F6 " " 140" 105°EP.

60"

300A Ab 5mt, 500/0, 10Cl<sub>2</sub>/20H<sub>2</sub>, 60" 800-1000TI F0 5mt, 500/100, 5Cl<sub>2</sub>/20HBr, 50" 800/1000 - 2300

IT

7/30/97

F0 3mt, 600/100, 4Cl<sub>2</sub>/12O<sub>2</sub>, 110"2mt, 500/100, 10HBr/20O<sub>2</sub>, 70"F5 3mt, 600/100, 4Cl<sub>2</sub>/12O<sub>2</sub>, 120"2mt, 600/0, 10HBr/20O<sub>2</sub>, 60"

Continued on Page \_\_\_\_\_

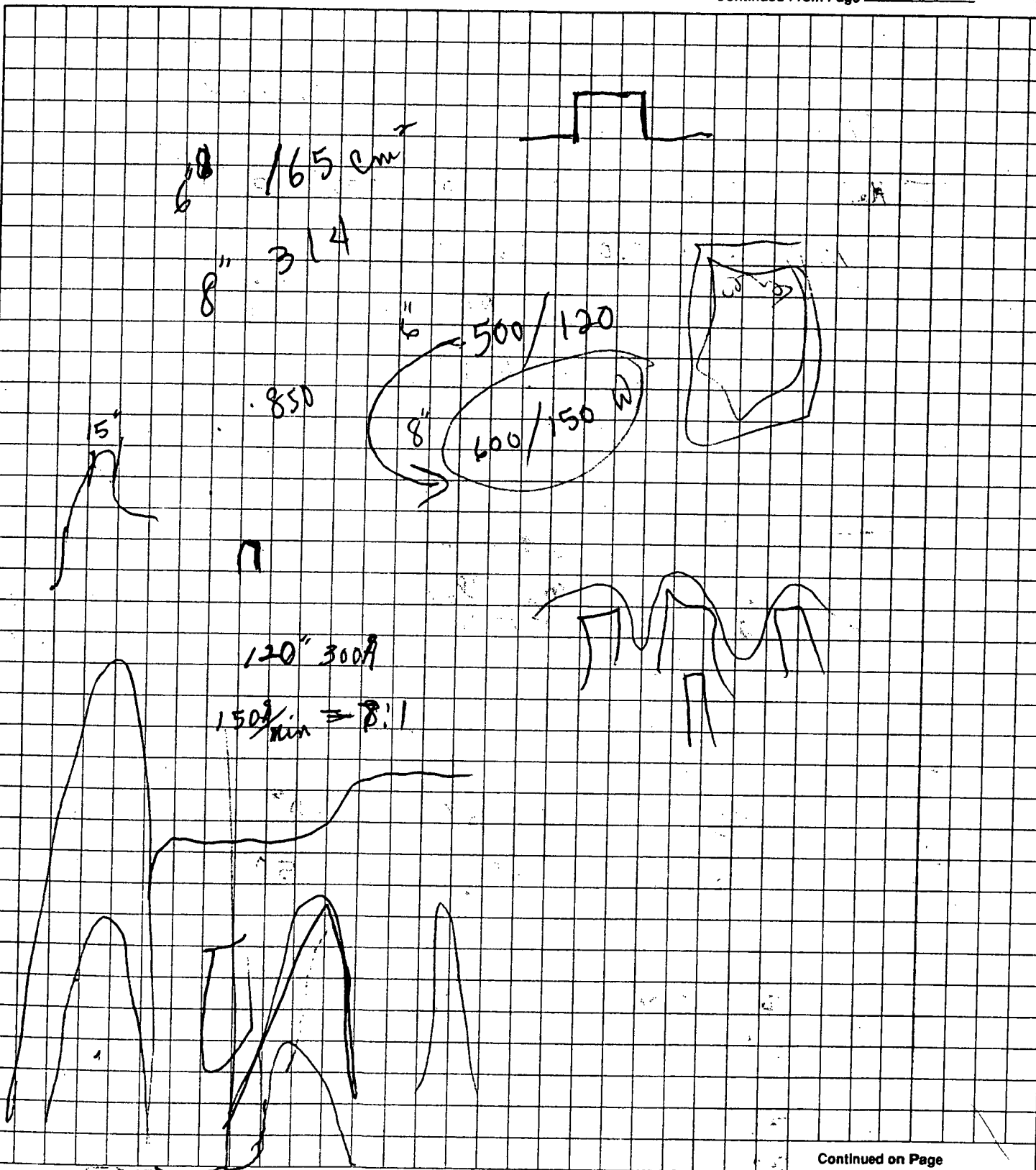
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Signed \_\_\_\_\_

Date \_\_\_\_\_

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Date \_\_\_\_\_



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Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

7/31/97

A6 { 2 mb, 600/100, 7 Cl<sub>2</sub>/21 O<sub>2</sub>, 120°  
 2 mb, 600/0, 10 HBr/20 O<sub>2</sub>, 60°

B3 { 3 mb, 600/100, 7 Cl<sub>2</sub>/21 O<sub>2</sub>, 120°  
 2 mb, 600/100, 10 HBr/20 O<sub>2</sub>, 60°

3 mb, 600/100, 7 Cl<sub>2</sub>/21 O<sub>2</sub>, 120° Best - C5  
 3 mb, 600/100, 7 HBr/20 O<sub>2</sub>, 80°

✓ H<sub>2</sub> Hea  
 2 or 3 mb, 600/100, 7 Cl<sub>2</sub>/21 O<sub>2</sub>, 140° 2 or 3 mb  
 3 mb, 600/100, 10 HBr/20 O<sub>2</sub>, 90° 2 or 3 mb, 0 or 100 kHz, 60-120° DC

✓ { Ti 5 mb, 500/0, 10 Cl<sub>2</sub>/20 Ar, 60° 1T 80°/80°  
 Maybe increase KHz from 0-100 W for cleaner PR + Vent. Pt etch

most likely best process

5 mb, 500/0, 10 Cl<sub>2</sub>/20 Ar, 60° 1T 80°/80°

Strip

2 mb, 600/100, 7 Cl<sub>2</sub>/21 O<sub>2</sub>, 120°  
 3 mb, 600/0, 10 HBr/20 O<sub>2</sub>, 90°

Continued on Page \_\_\_\_\_

Read and Understood By \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_



Run Blankets T.W.

1252 90° 5mb, 500/100, 10CH<sub>2</sub>/20A<sub>1</sub>, 60° clear T: 600 f

1325 100° 2mb, 600/100, 10HB<sub>1</sub>/20D<sub>2</sub>, 70° Pt clear 2100 f

120° 2mb, 500/100, 10HB<sub>1</sub>/20D<sub>2</sub>, ~ +180° +180° +180°

11 30° no meas. T: N loss

8 30° additional 2370 stop No T: N loss

2552 70°

T: N = 18 f/min

Pt = 1136 f/min

22

63:1

1 TiD loss for 80° O.E. is est at 24 f

This would allow ~ 40 cycles per T: N wafer of 1000 f.

Continued on Page

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Signed

Date

Signed

Date

	300	346	6.94	
	500	420	8.72	
	700	504	10.4	148 3.14
SNA 14	300	324	6.08	
	500	<del>420</del>	<del>8.72</del>	
	700	456	9.40	
SNA 24	300	340	7.04	
	500	420	8.7	
	700	504	10.5	

Continued on Page \_\_\_\_\_

Read and Understood By \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

PROJECT \_\_\_\_\_

Continued From Page \_\_\_\_\_

Temp. Rise

on wafer in chamber  $48^{\circ}\text{C} \rightarrow 65^{\circ}\text{C}$  with RF  
 no change when wafer dropped

	300/0	700	18.0	-396		
	500/0	880	23.2	-501		
	700/0	1220	28.8	-672		
1.2N	300/100	2160	22.0	-767	1380 K	960 M
1.2	300/200	2820	22.0	-1010	2120	1040
1.7W	500/100	2060	26.4	-777	1220	1120
3.6W	500/200	2800	27.6	-1030	1920	1240
3.6W Ref	700/100	2140	30.4	-836	1100	1320
3.8	700/200	2780	30.8	-1050	1820	1420

Continued on Page \_\_\_\_\_

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Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

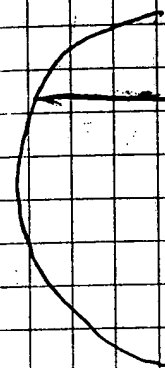


PROJECT \_\_\_\_\_

9/25/97

5 mt, 500/100, 10 Cl<sub>2</sub>/20 Ar, 40 + 45° 50°

3 mt, 600/100, 7 Cl<sub>2</sub>/21 O<sub>2</sub>, 60°  
2 mt, 600/100, 10 HBr/20 O<sub>2</sub>, 120° 90°



1. No DUV w/Resist S/T: N S/No T: N
2. Etch w/DAU mask no/pt
3. 150° 110 + 120
4. 5 mt O.E. No DUV

Continued on Page \_\_\_\_\_

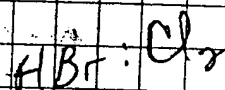
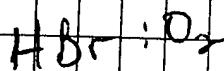
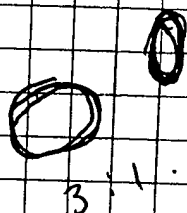
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Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_



50  
60

45  
15

48

14 12  
 3 36  
 4 2 6 9 12 15  
 6 5 0

28 4- 60 0 25 50

450		750
500	600	700
50	100	150
800	600	800
80	100	200

450	600	750
50	100	150

450	600	750
0	75	150

Continued on Page \_\_\_\_\_

Read and Understood By \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

PROJECT \_\_\_\_\_

Continued From Page \_\_\_\_\_

11/7/97

1200 A T:  
 600 A T:N

5 mb, 500/50, 10 Cl<sub>2</sub>/20 Ar, 70°  
 55°<sup>EP</sup>

11/8/80

T: 1000 3 mb, 600/100, 7 Cl<sub>2</sub>/21 O<sub>2</sub>, 60°  
 25 2 mb, 600/150, 10 HBr/20 O<sub>2</sub>, 240°

T: N 600 3 mb, 60°  
 55 2 mb, 180°

T: 1000 5 mb, 400/0, 20 Cl<sub>2</sub>, 60° (10°?)

10/8/97

1000 T: 5 mb, 500/0, 10 Cl<sub>2</sub>/20 Ar, 65°

600 T:N " " " 45°  
 45°  
 42°

600 A T:N 3 mb, 600/100, 7 Cl<sub>2</sub>/21 O<sub>2</sub>, 30°  
 2 mb, 600/100, 10 HBr/20 O<sub>2</sub>, 80° + 80°  
 65 180 A T:

1000 A T: " "

#26

Continued on Page \_\_\_\_\_

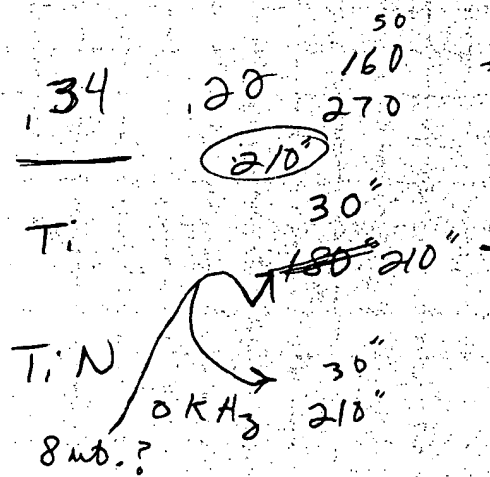
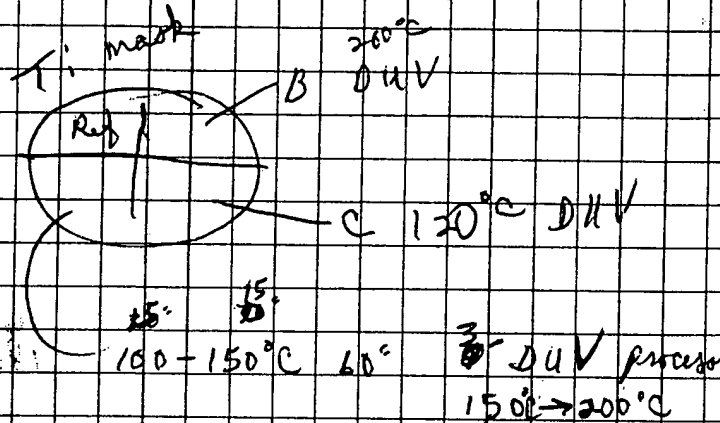
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Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_



Continued on Page \_\_\_\_\_

Read and Understood By \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

PROJECT \_\_\_\_\_

6"  
Ti Mask

10/9/97

#75 T.N  
3mb, 600/100, 7Cl<sub>2</sub>/21D<sub>2</sub>,  
2mb, 600/150, 10HB<sub>2</sub>/20D<sub>2</sub>,  
100

30"  
65"  
~~200~~  
200

#27 T.  
11 700W  
~~100W~~

30"  
~~200~~

50"  
40"  
60"

#28 3.0 mb, 600/100, 7Cl<sub>2</sub>/21D<sub>2</sub>, 30"  
2.0 10HB<sub>2</sub> 20 210"

10/10/97

#29

8mb

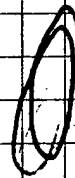
30  
210

#88

3.0 mb  
2.0 mb

/0

30  
210



LG#2

5mb, 500/0, 15Cl<sub>2</sub>/30D<sub>2</sub>, 50"

LG

10/29/97

3mb, 600/180, 10Cl<sub>2</sub>/30D<sub>2</sub>, 30"  
2mb, 600/120, 15HB<sub>2</sub>/30D<sub>2</sub>/10A, 130"

1870 V<sub>pp</sub> 29.6 A<sub>pp</sub>  
- 609 V DC  
Bias.

2mb, 600/120, 15HB<sub>2</sub>/30D<sub>2</sub>/10A, 180" (70° E.P.)

Continued on Page \_\_\_\_\_

Read and Understood By \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

PROJECT \_\_\_\_\_

Continued From Page \_\_\_\_\_

10/29/97

LG

LG#3

5mt, 500/0, 10CL<sub>2</sub>/20A<sub>1</sub>, ~45°

3mt, 600/100, 10CL<sub>2</sub>/30O<sub>2</sub>, 30°

5mt, 700/100, 30HB<sub>1</sub>/30O<sub>2</sub>/10A<sub>2</sub>, (E.P.+80°) 240°

O.E. 600  
20R

180°

2460 V<sub>1</sub>  
33.6 A<sub>1</sub>  
-576  
2140 V<sub>1</sub>  
30.4 A<sub>1</sub>, +57

11/5/97

LG#4

5mt, 600/100, 15CL<sub>2</sub>/30A<sub>1</sub>, 50°

3mt, 600/100, 10CL<sub>2</sub>/30O<sub>2</sub>, 30°

5mt, 700/150, 30HB<sub>1</sub>/30O<sub>2</sub>, 270° No E.P.?

" " " " 180°

LG#5

5mt, 600/100, 15CL<sub>2</sub>/30A<sub>1</sub>, 50° 210° sand, 500/0, 45° OT

3mt, 600/100, 10CL<sub>2</sub>/30O<sub>2</sub>, 30°

5mt, 700/150, 30HB<sub>1</sub>/30O<sub>2</sub>/20A<sub>1</sub>, 240° (20° E.P.) 120° Repet

2mt, 700/150, 15HB<sub>1</sub>/30O<sub>2</sub>/20A<sub>1</sub>, 180°

Done!

Continued on Page \_\_\_\_\_

Read and Understood By \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

PROJECT \_\_\_\_\_

Continued From Page \_\_\_\_\_

1 B  
 5mb, 500/0, 10 Cl<sub>2</sub>/20 Ar, 45"  
 5mb, 700/150, 15 Cl<sub>2</sub>/30 O<sub>2</sub>/0 Ar, 215"  
 5mb, 700/150, 10 Cl<sub>2</sub>/20 O<sub>2</sub>/10 Ar, 180"

11/10/97

Resist

5200 Lge Feat. 4000 post  
 1200 DHV 5130 " 4530 "

2 B  
 5mb, 500/0, 10 Cl<sub>2</sub>/20 Ar, 120" 3T 2370A Post  
 " " 100 " " 180" 3T E.P. 3310A Lge Feat.  
 5mb, 600/100, 20 HBr/30 O<sub>2</sub>, 120" 3T 1381 Post  
 3600 Lge Feat.

5mb, 500/0, 10 Cl<sub>2</sub>/20 Ar, 80" 1T 3200A Post  
 100 40" 3T 9200 Lge Feat.

3 B  
 5mb, 600/100, 10 Cl<sub>2</sub>/30 O<sub>2</sub>, 30" 3T  
 5mb, 600/100, 10 HBr/30 O<sub>2</sub>, 160" 3T Not clear.

30" 3T Not clear on T.  
 180" 3T 1800 Post  
 2000 Lge Feat.

5mb, 500/0, 10 Cl<sub>2</sub>/20 Ar, 30" E.P.  
 100 60" 4000 post 9500  
 60" 3600 post 4500

5mb 7 Cl<sub>2</sub>/21  
 10 HBr/30 O<sub>2</sub> 30" 2850 post 2830  
 15 " " 40" 45" 190"  
 2mb

Continued on Page \_\_\_\_\_

Read and Understood By \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_

PROJECT \_\_\_\_\_

Continued From Page \_\_\_\_\_

11/12/97

8" ESC

3mb, 500/0, 10Cl<sub>2</sub>/20Ar, 30"EP, 45" IT  
 5mb, 100, 7, 75" IT 4300R 4900R LG 1st  
 2H .41A CO gain

10mb, 500/0, 450, 240" OT OV ESC 2750 1900 LG  
 Left Tape. ~ 2700 1600 PE etch  
 1100R PE remain.

3mb, 600/100, 7Cl<sub>2</sub>/21O<sub>2</sub>, 30" RT Top 2700 2700  
 5mb, 600/100, 10HB<sub>1</sub>/300, 100" Mark to scan 1.1 mb

5mb, 600/100, 10HB<sub>1</sub>/300, 10Ar, 120" 2500 2650 LG

4840	5148	1BA	No DUV	90°	DUV	Reamp stat
4750	5093	1BB	90-120°C DUV	LG Process	30	60 30
3731	4916	1BC	90-200°C "	LG	30	60 30
2355	4782	1BD	100-200°C "	B	30	240 30

90-200°C

0, 120°, 150°, 180°

90°C start 1°/sec

120 60" 15"  
 150 120" 60" 30"

180 180" 90" 45"

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Continued on Page

Signed \_\_\_\_\_

Date \_\_\_\_\_

Signed \_\_\_\_\_

Date \_\_\_\_\_



Scale-up process:

3 m, 700/100, 1000/300, 30°

2 mb, 700/100, 20 MB/400, E.A.

	A	Ramp Time	Hold	DUV	LG Process
4MA 90°-120°	30°	15 sec	45 sec	60°	
4MB 90-150°	60°	30 "	30	"	
4MC 90- <del>175</del> °	85°	42 "	18	"	3-5
4MD 90-200°	110°	55 "	5	150°	

LG Process

3	5	8
---	---	---

55 " 5 5.48 13.07  
600/100 45

860/200

800/200 5AB/15

600	100
-----	-----

1000 Å Diff  
dense to open

3852  
340

2,104,2

Continued on Page

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Date \_\_\_\_\_

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Date \_\_\_\_\_

11/13/97

Right 3 mt, 100/100, 2 ~~100~~ 210, 30°  
 Tape 5 mt, 600/100, 100/300, 100, 240° (120x2) + 50°

#1 Left 5 mt, 500/0, 10 O<sub>2</sub>, 30° BARC 150A  
 Tape 5 mt, 500/0, 10 O<sub>2</sub>, 200, 140° EP, 80° T: N 1000R.

151 O.E.

120°

101

501

#2

30° BARC

20° I 80° T: N etch. 110° TH.

3 M

5451A after 30° O<sub>2</sub> + 100° T: N 20° I, 16° RE.

1511C

1622R 1710L

Barc.

#2 M

3 mt, 600/100, 7 ~~100~~ 210, 30°

3104 L

3 mt, 700/100, 15 HB, 450, 90°

3044 C

3347 R

120°

3820 C

3'5"

3168 C

85°

3875 R

+ 80°

3322 R

65°

3945 L

+ 80°

3349 L

270

4 min.

1000

2500

3500

260° - 115A min. Edge

198A min. Center

160A min. Mask

3, 5, 90° EX ER, Test.

Continued on Page

560 A/pt

610 700 800  
 100 150 200  
 5 10 15 HB  
 25 30 45 O<sub>2</sub>

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6:50

Signed

Date

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Date

3 mt, 200/100, 10 Cl<sub>2</sub>/30 O<sub>2</sub>

7/14 12/14  
14/42 7/21  
7/21 14/42  
10/20  
20/40

2 mt, 710/100, 20 HB<sub>2</sub>/40 O<sub>2</sub>

		HB <sub>2</sub>	O <sub>2</sub>
2 mt	+ 800/200	5	15 ✓
5 mt	+ 600/100	15	45 ✓
8 mt	+ 400/100	10	20 ✓
		20	40 ✓

3 mt, 600/100, 7 Cl<sub>2</sub>/21 O<sub>2</sub>

2 mt, 800/200, 5/15  
20/40

100° 60°

5 mt, 600/100, 5/15  
20/40

100° 60°  
2592 1050  
2592 893

Continued on Page \_\_\_\_\_

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3 mb, 700/100, 15 HB<sub>1</sub>/45 O<sub>2</sub>, 120° 83A 41A/min.

250  
167 remain

T.N 2 mb, 800/200, 20 AB<sub>1</sub>/40 O<sub>2</sub>, 120° + 130° + 130° 450° 24A/min.

20 cl<sub>2</sub>

7167A

PE F<sub>1</sub> 90°

90°

1741 L

45 P

33

29A/min

80

40A/min

1811 C

1130A

25

29A

80

40A/min

1535 R

45 P

59

29A

80

40A/min

35087

45 P

51696

45 P

525

5 mb, 600/100, 10 HB<sub>1</sub>/200 O<sub>2</sub>, 120° 350A/min. 8:1

5 mb, 700/100, 15 HB<sub>1</sub>/45 O<sub>2</sub>, 180° 3172 58A/min.

1050 L

1016 C

893 R

3/2959

786

493A/min 120°

65° Clear T.N.

8.4:1

58 1993

483

290

1700 30 56 1700A/min 150 200

50:1

3M

3 mb, 600/100, 10 cl<sub>2</sub>/30 O<sub>2</sub>, 30°  
2 800/200 20 HB<sub>1</sub>/40 130° E.P.

+120° 2E.

Continued on Page \_\_\_\_\_

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Date \_\_\_\_\_

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Date \_\_\_\_\_

2+5

15/45

80/100

134

33R

2 mb 800/100, 15/45

5 mb 800/100, 20/40

2 800/200, 20/40  
45R

700

120

1030

100

1000

1500

1020

600R

25/30R T.D

1200-1500 ft

$$\frac{12.75}{240} = \frac{6.75}{X}$$

20" I

10" O.E.

240

130"

280"

265"

Continued on Page \_\_\_\_\_

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11/18/97

5mb, 350/0, 10 O<sub>2</sub>, 20"  
 5mb, 600/0, 10 Cl<sub>2</sub>/20 Ar, 100" 20" Int. 10" O.E.  
 10mb, 500/0, 450<sub>2</sub>, 30" Strip 120" Tot.

HBR MFC Failed

Small Feature wiped out

800/200 W	(23:1)	800/100 W	53
182 R	48 min. T.N	47 T	17 1922
92 C		42 C	17 1922
156 L		61 F	17 1922
48 1100		31 150	17 1922
96		31 50	17 1922
140		17	17 1922
3 430	1142	867 C	PE
3 43	1059	812 L	902 min
18	1099	1027 R	
	3300	3270 L	
		502	

1000 700 2:1 T.N:PR 6600 A Pool T.N etch thickness  
 1300

5mb, 600/0, 10 Cl<sub>2</sub>/20 Ar, 130" 35" Bare 15" O.E.  
 1200 P more strip without O<sub>2</sub> 800" T.N.  
 1571-1711 A after Ash 1 hr.

# M 6

3mb, 600/100, 10 Cl<sub>2</sub>/30 O<sub>2</sub>, 20"  
 2mb, 800/100, 20 Ar/40 O<sub>2</sub>, 170" E.P.

10442 4026 C  
 11303 906 R

+ 90"

25" BARC 4 628 R 11/20/97  
 5mb, 600/50, 15 Cl<sub>2</sub>/20 Ar, 600" E.P. 30" O.E. 115" Tot.

# M 7

3mb, 600/100, 10 Cl<sub>2</sub>/30 O<sub>2</sub>, 30"  
 2mb, 800/100, 20 Ar/40 O<sub>2</sub>, 145"

120"  
 120"

Continued on Page \_\_\_\_\_

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Date \_\_\_\_\_

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Date \_\_\_\_\_

3 mb, 800/151, 1548, 4502

20CF / 80CF / 1150 / 225

5000 / 150

2000 / 100

Steve M. Zhang

140" No etch CF/10/30  
100" etch CF/10/30  
20" TOS: N

M next

Increase KHz mask open to 100-150-200W trench to bridge.  
2 step etch 200W K Bulk Trench/mask/space  
100W K O.E.

- 1 Pressure from 2 → 5 mb to open narrow space.

5 mb, 600/0, 10 Cl<sub>2</sub>/20 Ar, 70"  
5 mb, 600/100, 20 Cl<sub>2</sub>/40 Ar, 30"

Continued on Page

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Date

Signed

Date

12/4/92

8M

5mb, 600/0, 10Cl<sub>2</sub>/20Ar, 130°3mb, 600/100, 10Cl<sub>2</sub>/30O<sub>2</sub>, 30°5mb, 750/175, 45HB<sub>2</sub>/45O<sub>2</sub>, 180°  
130°

12/5/92

PC 1

5mb, 600/0, 10Cl<sub>2</sub>/20Ar, 60° 50°EP3mb, 600/100, 10Cl<sub>2</sub>/30O<sub>2</sub>, 30°3mb, 700/150, 45HB<sub>2</sub>/45O<sub>2</sub>, 120°

+30° → 5mb, 700/200, " " 180°

200W  
500W Arc 60°

#119

5mb, 600/0, 20Cl<sub>2</sub>/30Ar, 110°25° PARC 52° T.N  
33° O.E.3mb, 600/100, 15Cl<sub>2</sub>/40O<sub>2</sub>, 30°5mb, 700/150, 20Cl<sub>2</sub>/30O<sub>2</sub>, 180°3mb, 800/100, 15HB<sub>2</sub>/45O<sub>2</sub>, 180°

E.P. St. N50°

35W Refl.

45W Refl.

Best Mask open

5mb, 600/0, 20Cl<sub>2</sub>/30Ar, 50° Total

5mb, 700/150, 30/30

3mb, 800/200, 15/45

N/A

3mb, 800/100, 30HB<sub>2</sub>/30O<sub>2</sub>3mb, 800/100, 40HB<sub>2</sub>/40O<sub>2</sub>3mb, 800/100, 30HB<sub>2</sub>/30O<sub>2</sub>

100 (+200°)

E.P. St.

Continued on Page

120° slope to 150° Total.

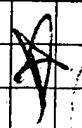
stood By

Signed

Date

Signed





	30' BARE MVI	45' BARE M12	PS26 27 28
5mb, 600/0, 10Cl <sub>2</sub> /20A, 115"		124"	55"
5mb, 600/0, 20 30 30"		30"	30"

PS26	PS26 M11
3mb, 600/100, 15Cl <sub>2</sub> /150, 30"	
5mb, 700/200, 45HB <sub>1</sub> /450, 240"	180"
5mb, 700/200, 15HB <sub>1</sub> /450, 60"	
3mb, 600/150, 15HB <sub>1</sub> /450, 180"	<del>180"</del>
5mb (M11)	180"

PS27	M12	
5mb, 700/150, 20HB <sub>1</sub> /200, 120"	180"	
5mb, 800/100, 30HB <sub>1</sub> /300, 180"	180"	
- 30µ	- 2µ	- 200 ESC V

5mb, 600/0, 20/30 M.O.  
5mb, 700/150, 30/30 B.E.  
5mb, 800/100, 30/30 O.E.

5mb, 600/0, 10Cl<sub>2</sub>/20A,  
20Cl<sub>2</sub>/40A,  
5mb, 750/200, 45HB<sub>1</sub>/450<sub>2</sub>  
5mb, 700/200, 15HB<sub>1</sub>/450<sub>2</sub>  
5mb, 600/0, 10Cl<sub>2</sub>/20A, BK  
5mb, 500/0, 15Cl<sub>2</sub>/30A, ME.  
5mb, 500/50, 10Cl<sub>2</sub>/20A,

PS30 M13

5mb, 700/150, 20HB <sub>1</sub> /200 <sub>2</sub> , 110"	
3mb, 700/150, 10HB <sub>1</sub> /10Cl <sub>2</sub> /10A/300 <sub>2</sub> , 180"	180"

Continued on Page \_\_\_\_\_

PS 30 12/20/10/30 Read and Understood By  
M13 10/10/10/20

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